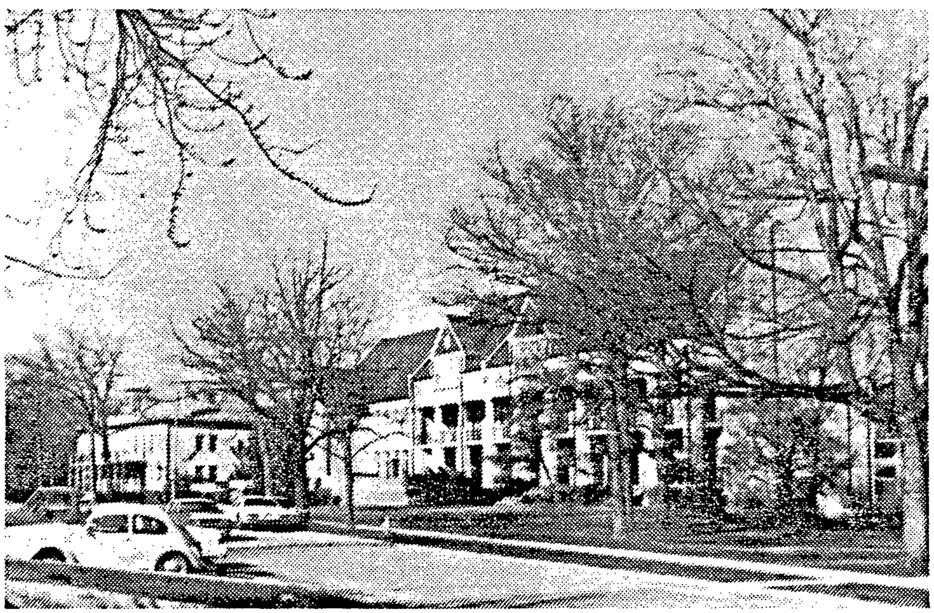
Apr 85

FINAL SUBMISSION

VOLUME I–EXECUTIVE SUMMARY

ENERGY ENGINEERING ANALYSIS PROGRAM

FORT SHERIDAN, ILLINOIS
BASEWIDE STUDY



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PROJECT ABSTRACT

BASEWIDE ENERGY STUDY (EEAP)

INCREMENTS A, B, F AND G

FORT SHERIDAN, ILLINOIS

This analysis was commissioned in April, 1985 by the Corps of Engineers, Louisville District to develop a plan to reduce energy consumption at Fort Sheridan in compliance with the objectives set forth in the Army Facilities Energy Plan (AFEP).

By following the plan developed under this study, annual energy cost savings for documented projects will be significantly reduced. The total cost of project implementation is estimated at $4,019,060.

The Report

The Energy Engineering Analysis consists of the final report with seven appendices.

The final report describes the purpose of the study, illustrates historical and forecasts basewide energy use trends, and summarizes each energy conservation project recommended for implementation.

Appendices include building data, cost data and calculations, scope of work, and minutes of meetings. Programming and implementation documentation are bound separately.

The executive summary is provided as a separate document and provides an overview of the project. It includes a list of all documented projects developed during the study with key data from the Life Cycle Cost Analysis.

EXECUTIVE SUMMARY
TABLE OF CONTENTS

List of Tables

List of Figures

List of Figures (Cont'd)

EXECUTIVE SUMMARY

1.1. Project Scope of Work

The EEAP is undertaken for the purpose of developing a plan to reduce energy consumption at Fort Sheridan in compliance with the objectives of the Army Facilities Energy Plan (AFEP).

Key elements of the study methodology incorporated in the AE investigative format are as follows:

1.1.1 Key Elements of Study

- Utilize, as appropriate, ongoing and previous energy related studies
- Perform an on-site audit of facilities, operations, and records.
- Identify all energy conservation opportunities and perform technical and economic feasibility analysis
- Prioritize all opportunities
- Prepare Project implementation documents for Army review and use
- Document study with a comprehensive report

2.1 Fort Sheridan Description

Fort Sheridan is located on the Lake Michigan shore bordered by the towns of Highwood, Lake Forest and Highland Park, Illinois. It is approximately 20 miles north of Chicago. A site location map and general site plan are shown in Figures 1 and 2.

Fort Sheridan was established as an army base in 1890. Between 1890 and 1895, 64 buildings were built. Thirty-eight buildings were constructed between 1890 and 1938. From 1939 to 1945 an extensive building program (91 units) was implemented. The remainder of the post is comprised primarily of family homes.

The original buildings (1890-1895) range from 3,000 to 27,000 square feet. They are generally two story brick buildings with pitched roofs.

The buildings built around World War II range from 1,000 to 22,000 square feet. They are generally two story frame buildngs with a combination of flat and pitched roofs.

The family housing built after the forties include units of 1,000 to 7,000 square feet. They are generally two story frame multiple family dwellings with a combination of flat and pitched roofs.

Fort Sheridan is an active installation. The base personnel include an administrative staff, officers, enlisted personnel, military dependents, and a significant number of civilians. As of March 31, 1985, the population totaled 5,436. Base staff projects the total population to remain at this level for the next 3 to 5 years.

Fort Sheridan is an area of frequent and rapid changes in weather. The climate is relatively cold in winter and mild in summer. Both winter and summer extremes are tempered by the Fort's proximity to Lake Michigan.

Fort Sheridan is the headquarters of the Fourth U.S. Army, U.S. Army Reserve, and numerous U.S. Army activities.

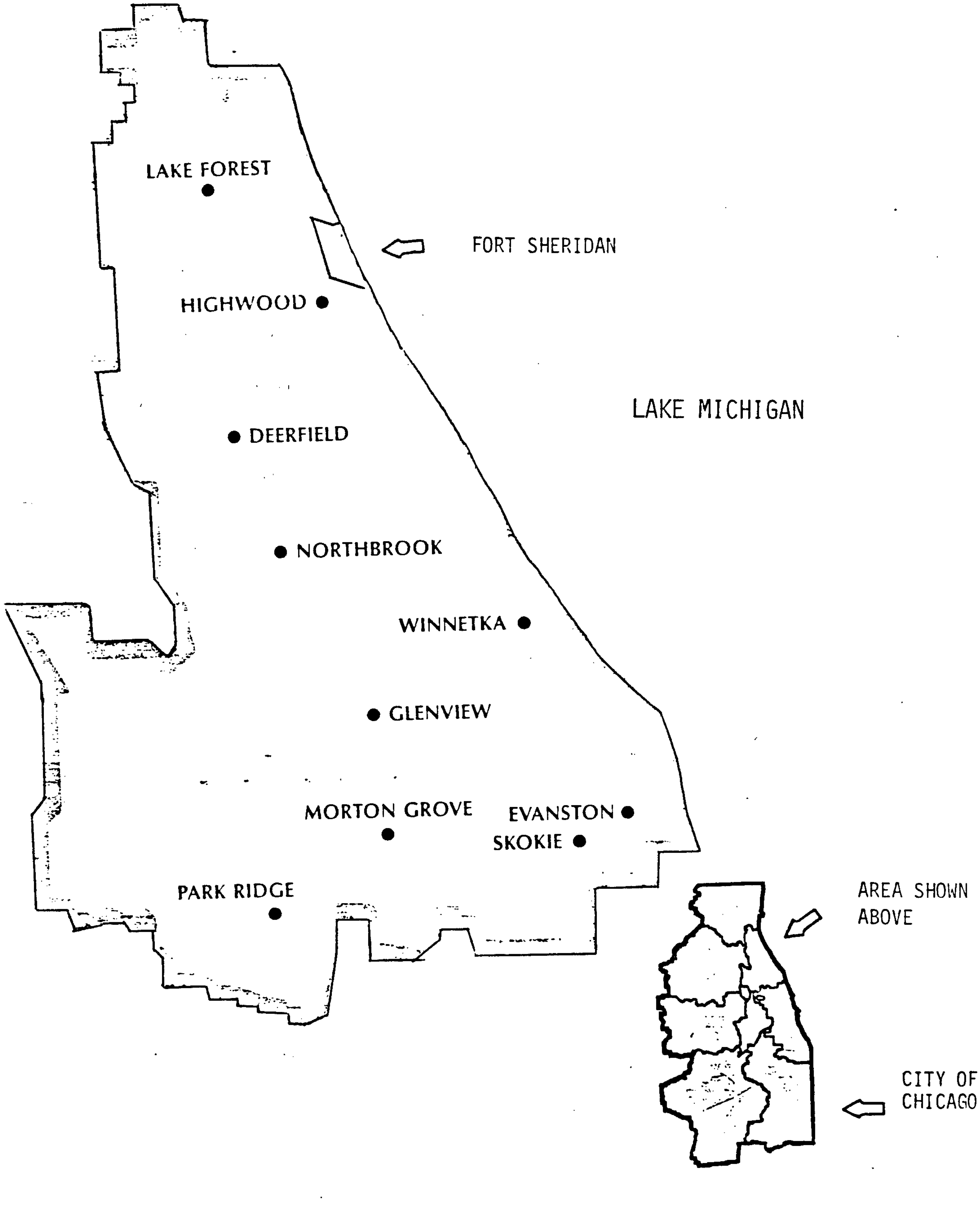

LAKE FOREST
FORT SHERIDAN
HIGHWOOD
LAKE MICHIGAN
DEERFIELD
NORTHBROOK
WINNETKA
GLENVIEW
MORTON GROVE
EVANSTON
SKOKIE
PARK RIDGE
AREA SHOWN ABOVE
CITY OF CHICAGO

Figure 1

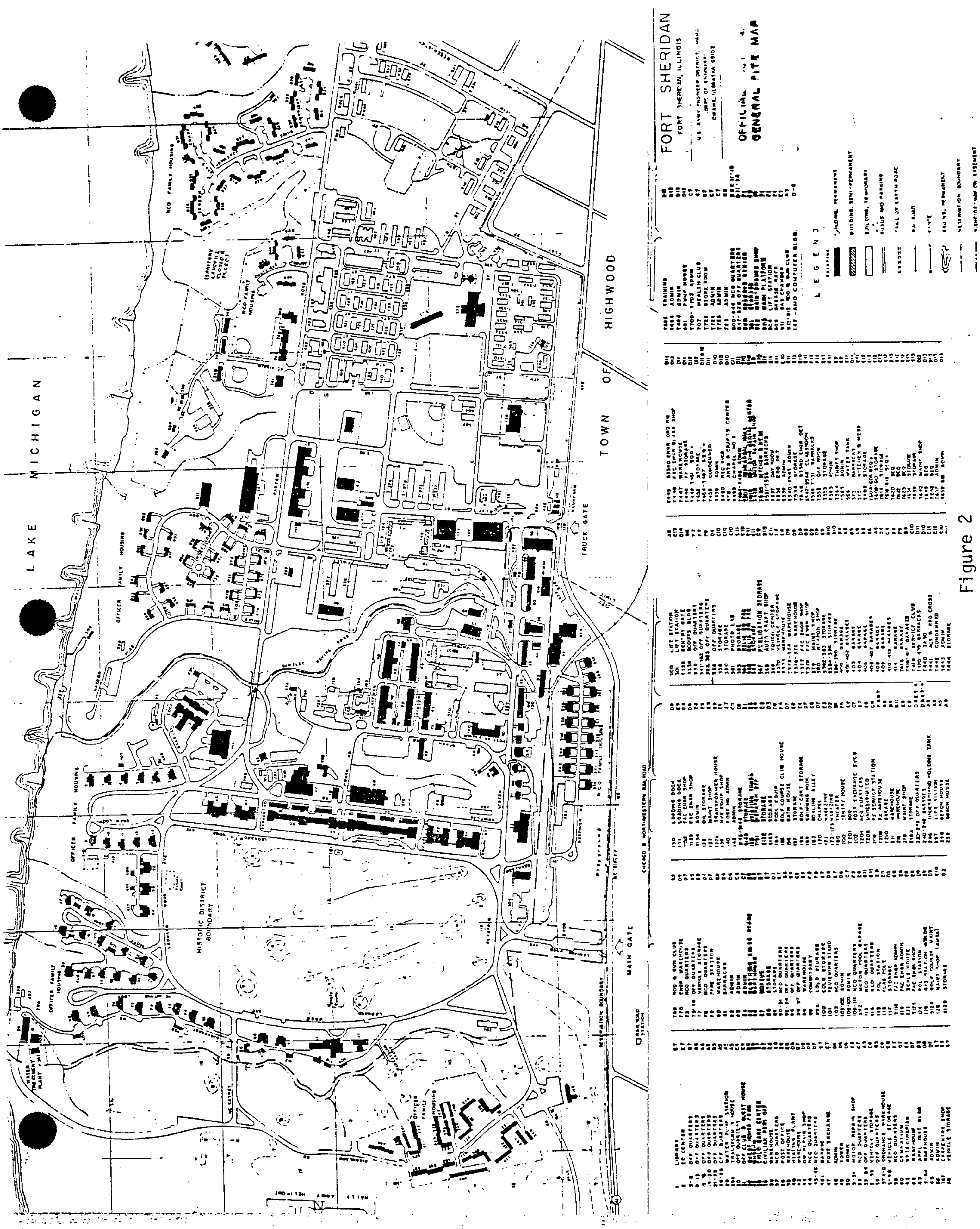

FORT SHERIDAN
FORT SHERIDAN, ILLINOIS
GENERAL SITE MAP
LEGEND
LAKE MICHIGAN
TOWN OF HIGHWOOD
TRUCK GATE
MAIN GATE
HISTORIC DISTRICT BOUNDARY
OFFICER FAMILY HOUSING
NCO FAMILY HOUSING
CHICAGO & NORTHWESTERN RAILROAD

Figure 2

3.1 Army Facilities Energy Plan

The Army Facilities Energy Plan establishes energy goals for Army facilities based on overall goals established under DOD directives and Executive Order 12003. The Government-Wide Energy Conservation Program administered by the Department of Energy is the Federal Energy Management Program which reports compliance with Executive Order, directives and goals of the National Energy Conservation Policy Act (NECPA).

The Army Energy Conservation goals for existing facilities include reducing total facility energy consumption by 20% by FY85 and 40% by FY2000 compared to FY75 consumption and reducing use of oil for heating by 75% by FY2000.

4.1 Basewide Energy Consumption and Cost

Figure 3 illustrates the historical basewide energy consumption for each energy source since 1975.

Figures 4 and 5 illustrate the cost escalation for electricty and gas since 1975.

Figures 6 thru 14 illustrate the most recent and current energy consumption and cost representative of the current and recent base functions, manning and level of facility utilization.

ANALYSIS OF FIGURES 3-5

Historical Energy Data

Figure 3 shows a plot of gas, oil, electric and total energy consumption for the period of FY76 thru FY85. Oil use dropped from FY76 to FY81 from 190,000 to 70,000 MBTUs. After FY81, consumption has remained steady. Natural gas use, however, has been increasing over the entire nine year period. Fort Sheridan, in the late seventies, converted a number of buildings from oil to gas heating. During this period, natural gas use increased from 204 to 254 thousand MBTUs. This 50,000 MBTU increase in gas is less than the 120,000 decrease in oil use. The 70,000 MBTU difference is due to increased conservation efforts and decreased building usage.

Electric consumption has been relatively steady over the nine year period. Total energy consumption from FY76 to FY81 dropped 15%, then reversed in FY82. Total use in FY85 is still less than that of FY76 or FY77.

Figures 4 and 5 show fuel unit cost escalation data for the period FY76 to

4.1 (Cont'd)

FY85. Electric rates have been rising at a consistent rate over the entire period. With an average cost of $6.27 per MBTU in FY76 and $20.51 in FY85, the average effective escalation rate, including compounding, has been over 14 percent.

Natural gas rates have increased from $1.45 per MBTU in FY76 to a peak of $4.56 in FY83. Rates have had a modest decline in FY84 and in FY85 to the $4.20 per MBTU level. Over the FY76-85 period, the average effective escalation rate, including compounding, has been 12.5 percent.

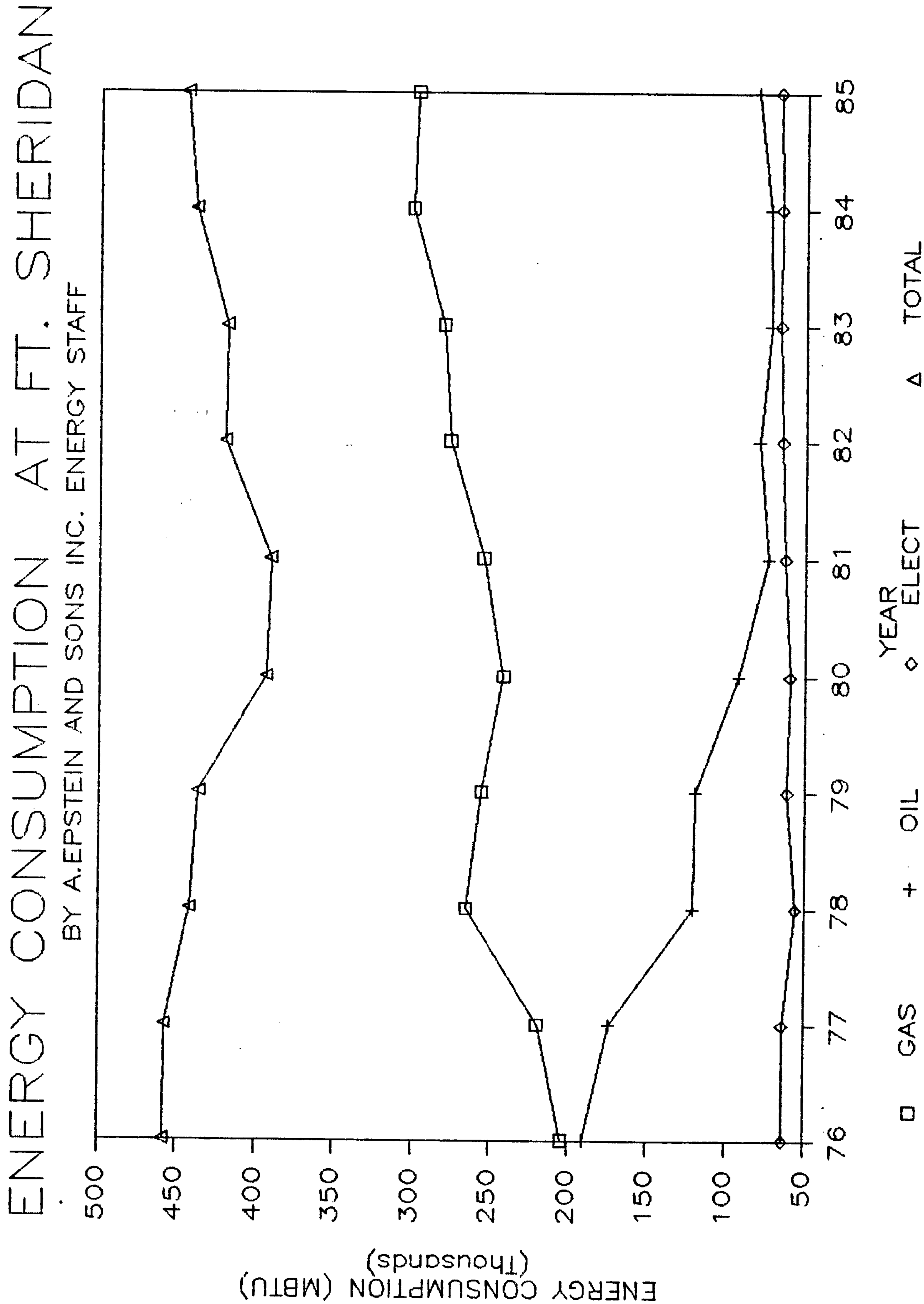

ENERGY CONSUMPTION AT FT. SHERIDAN
BY A.EPSTEIN AND SONS INC. ENERGY STAFF
ENERGY CONSUMPTION (MBTU)
(Thousands)
500
450
400
350
300
250
200
150
100
50
76
77
78
79
80
81
82
83
84
85
YEAR
GAS
OIL
ELECT
TOTAL

Figure 3

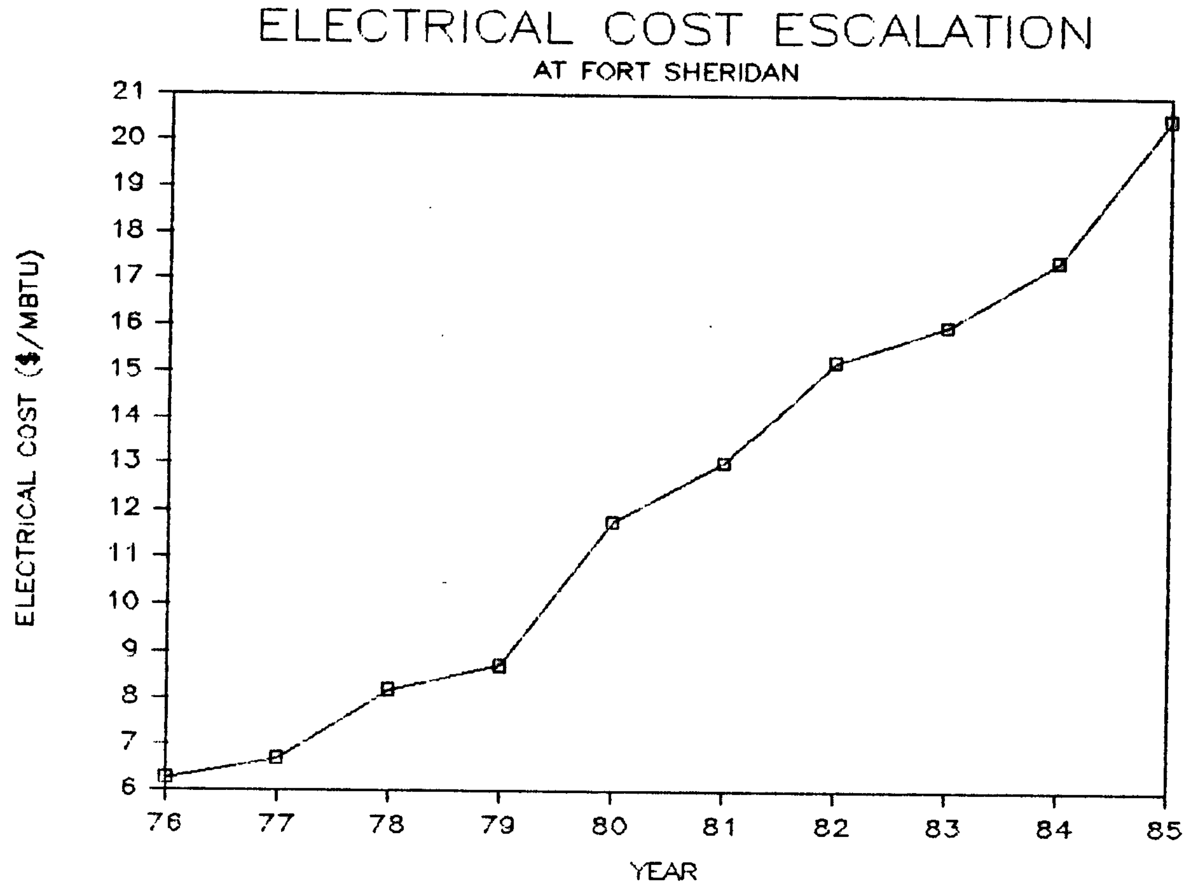


Figure 4

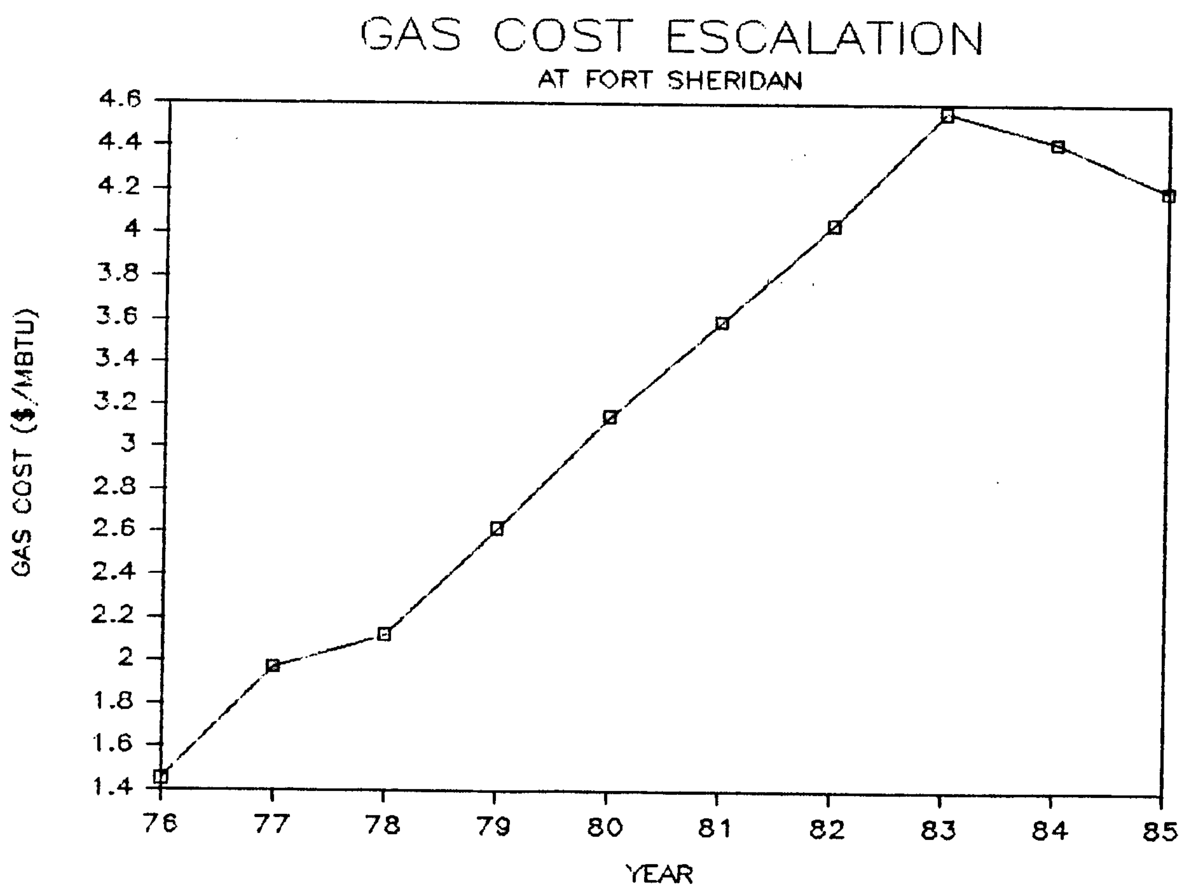


Figure 5

4.1 (Cont'd)

ANALYSIS OF FIGURES 6 THRU 14 - RECENT ENERGY USE/COST.

Figures 6 and 7 depict energy usage and cost for FY85. The total energy cost for FY85 was $3,239,848 and the total usage was 448,217 MBTU. Although electric use is only 16% of the total, it represents 44% of the expense. Natural gas use was 66%, but was only 39% of the energy cost, as illustrated in Figure 7.

Figure 8 shows a twelve month plot of gas use. The pattern represents the expected inverse relationship of gas use with outdoor temperature. The summer baseline usage is approximately 7,000 MBTUs per month, which is needed to operate the Central Boiler Plant for domestic hot water, office reheat, and household cooking purposes.

Figures 9 and 10 are graphs of twelve month electric usage for FY85.

Figures 11 thru 13 provide a graphical presentation of the monthly energy use for each energy source during FY83/84/85. Figure 14 provides a comparison of total monthly energy use for FY83/84/85.

The only significant monthly variation is attributable to variations in seasonal heating requirements.

It is significant that the summer use of steam exceeds the energy requirements for all electrical requirements for cooling, ventilation, power, and lighting.

The addition of cooling units to administrative space currently under construction and programmed for future construction will be reflected in a rise in spring and summer use of electricity and demand in future years.

ENERGY CONSUMPTION AT FT. SHERIDAN

FOR FISCAL YEAR 85

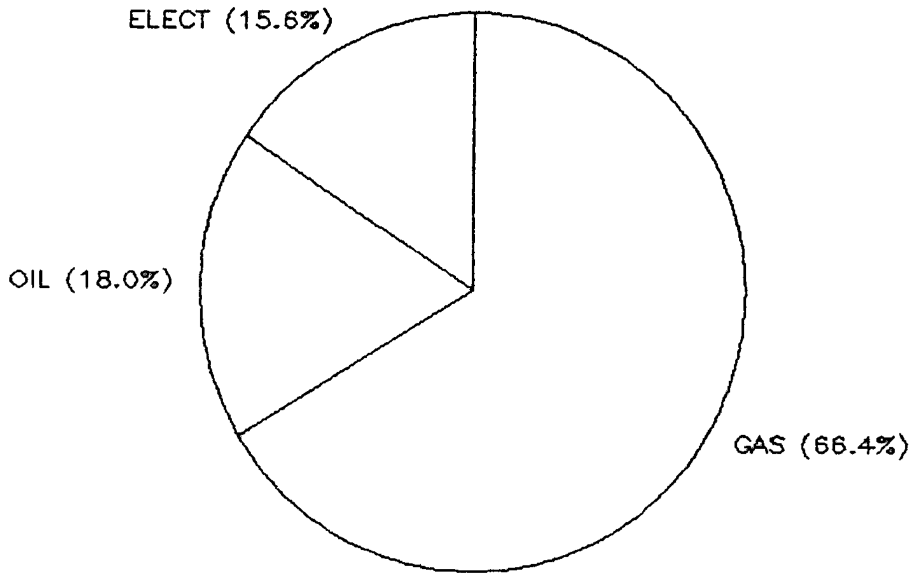


Figure 6

ENERGY COST AT FT. SHERIDAN

FOR FISCAL YEAR 85

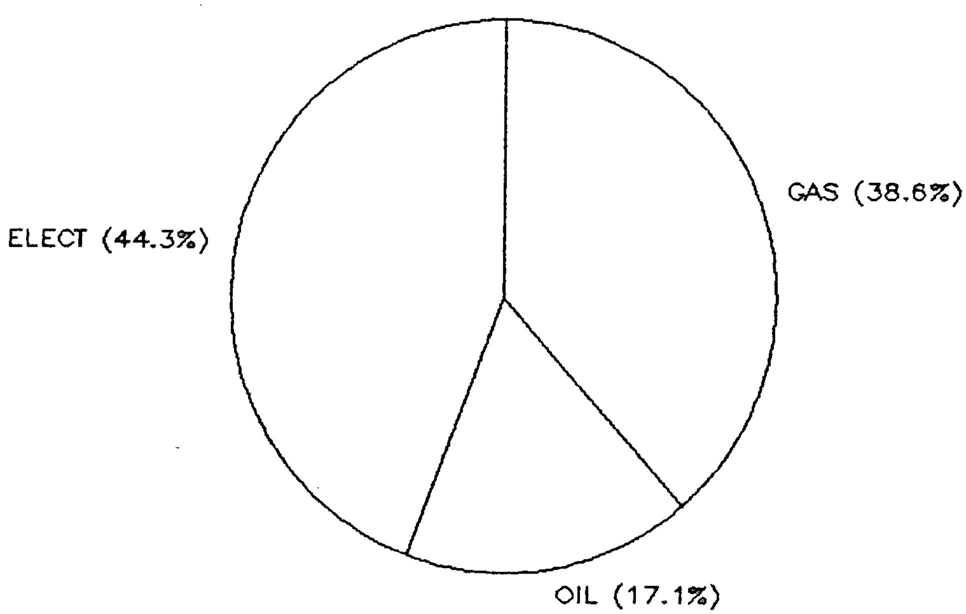


Figure 7

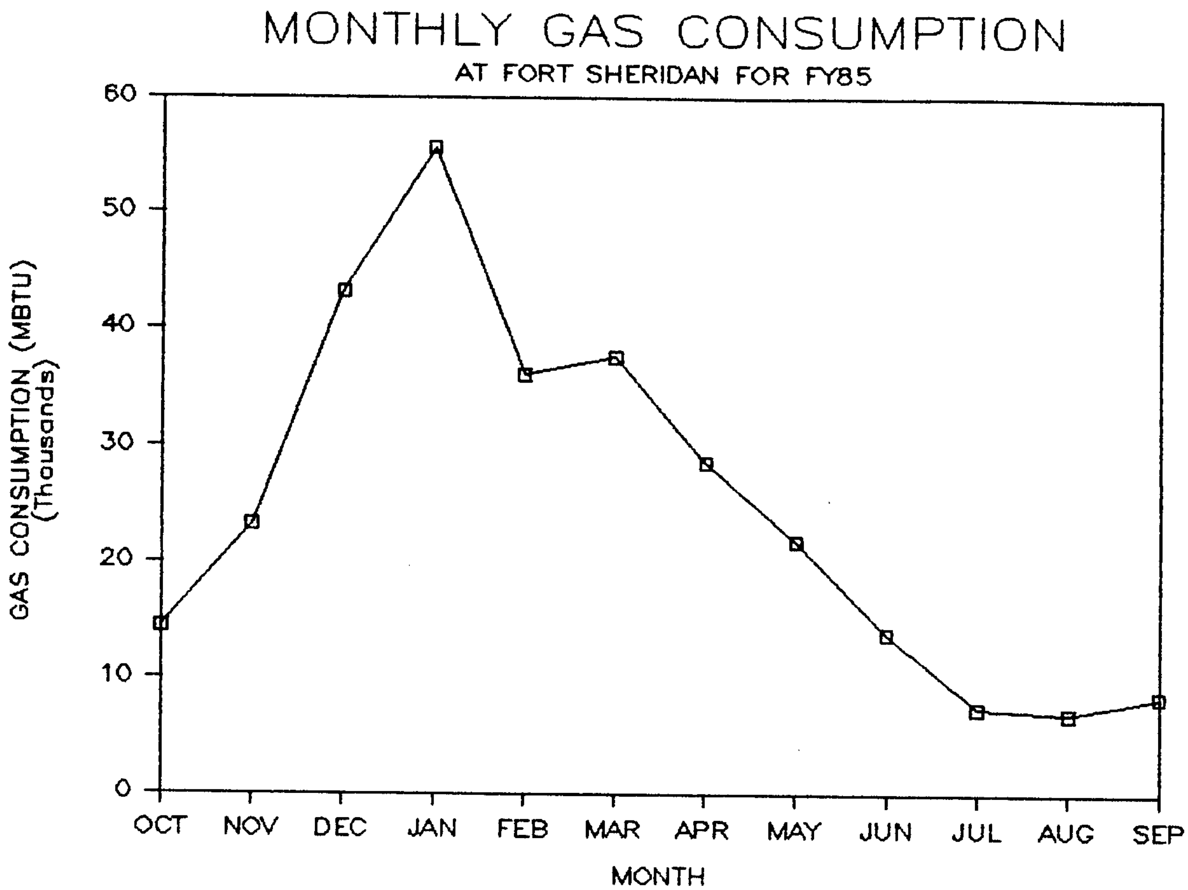

MONTHLY GAS CONSUMPTION
AT FORT SHERIDAN FOR FY85
GAS CONSUMPTION (MBTU)
(Thousands)
60
50
40
30
20
10
0
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
MONTH

Figure 8

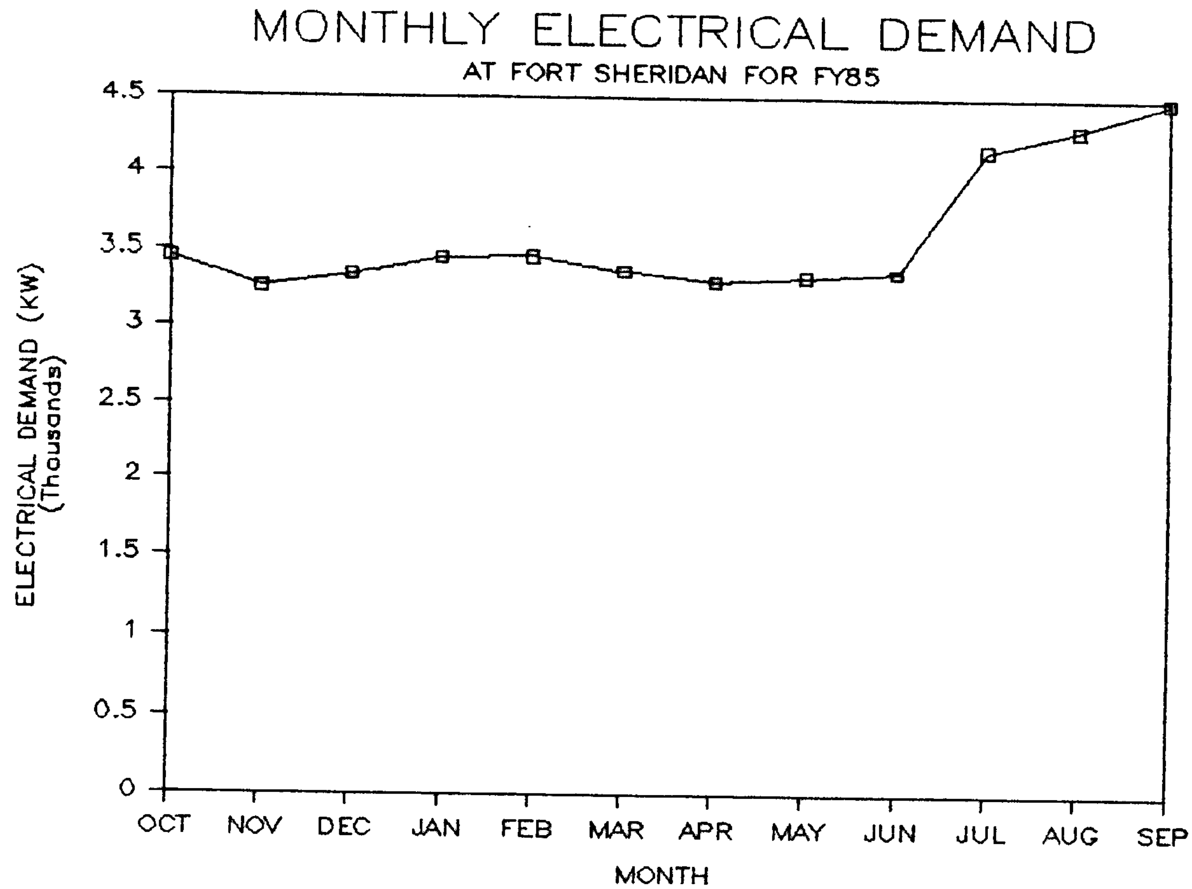


Figure 9

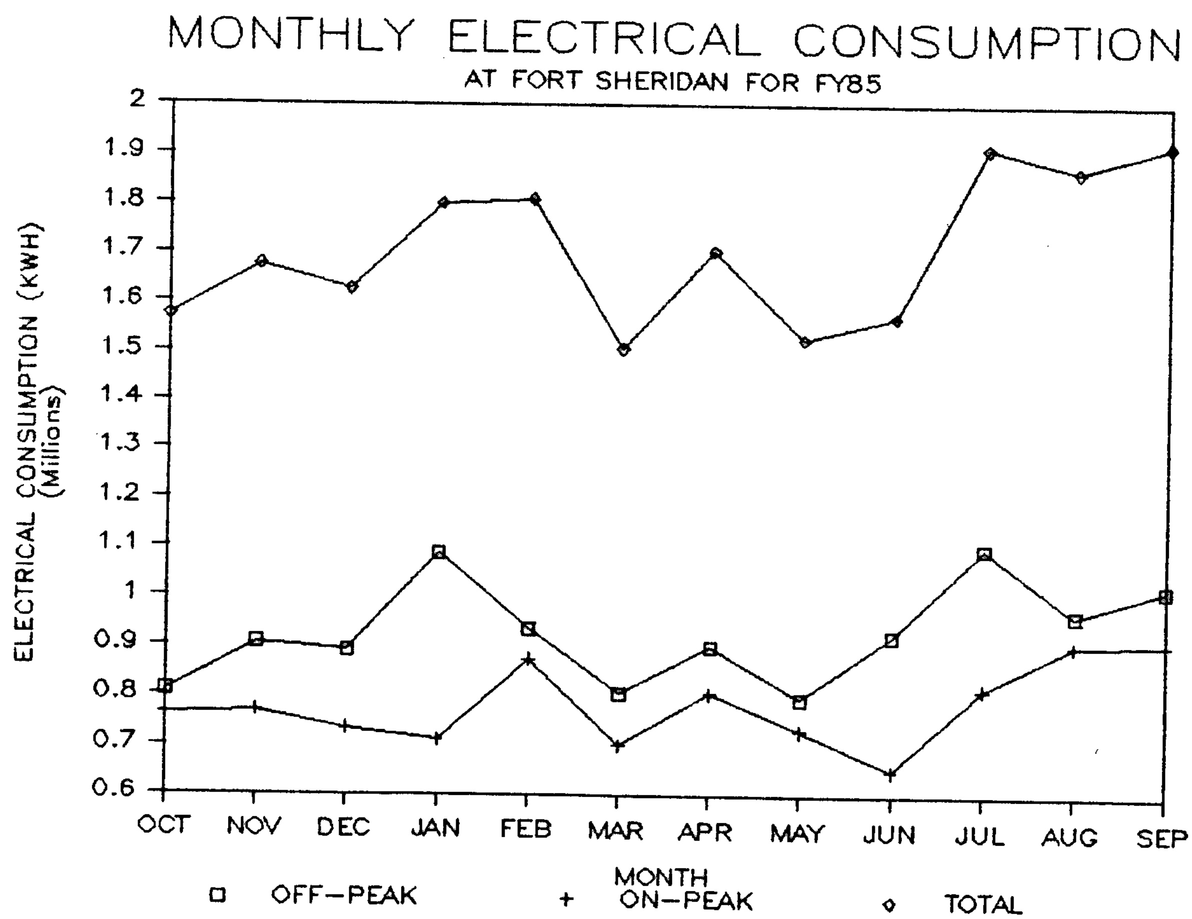


Figure 10

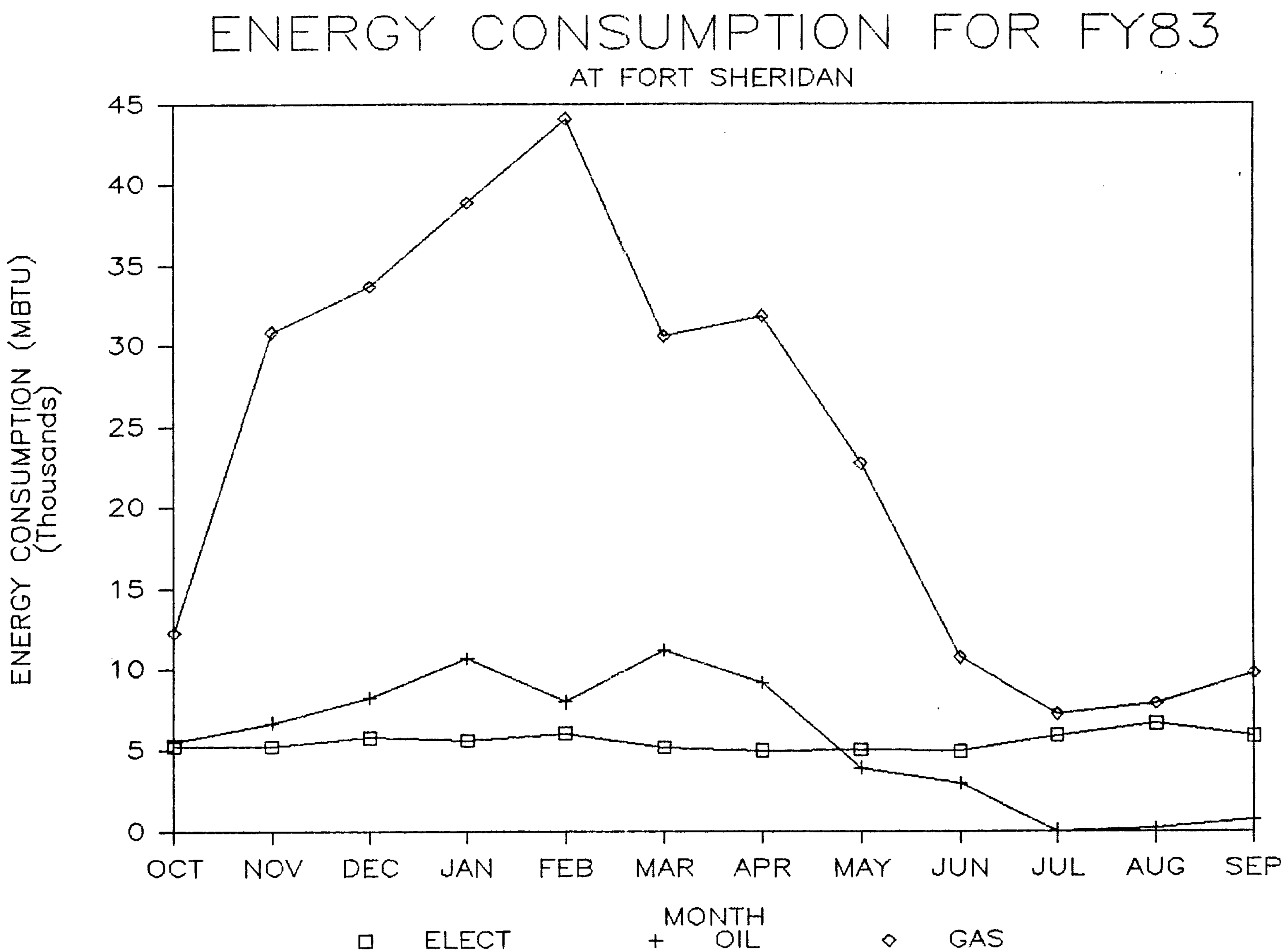
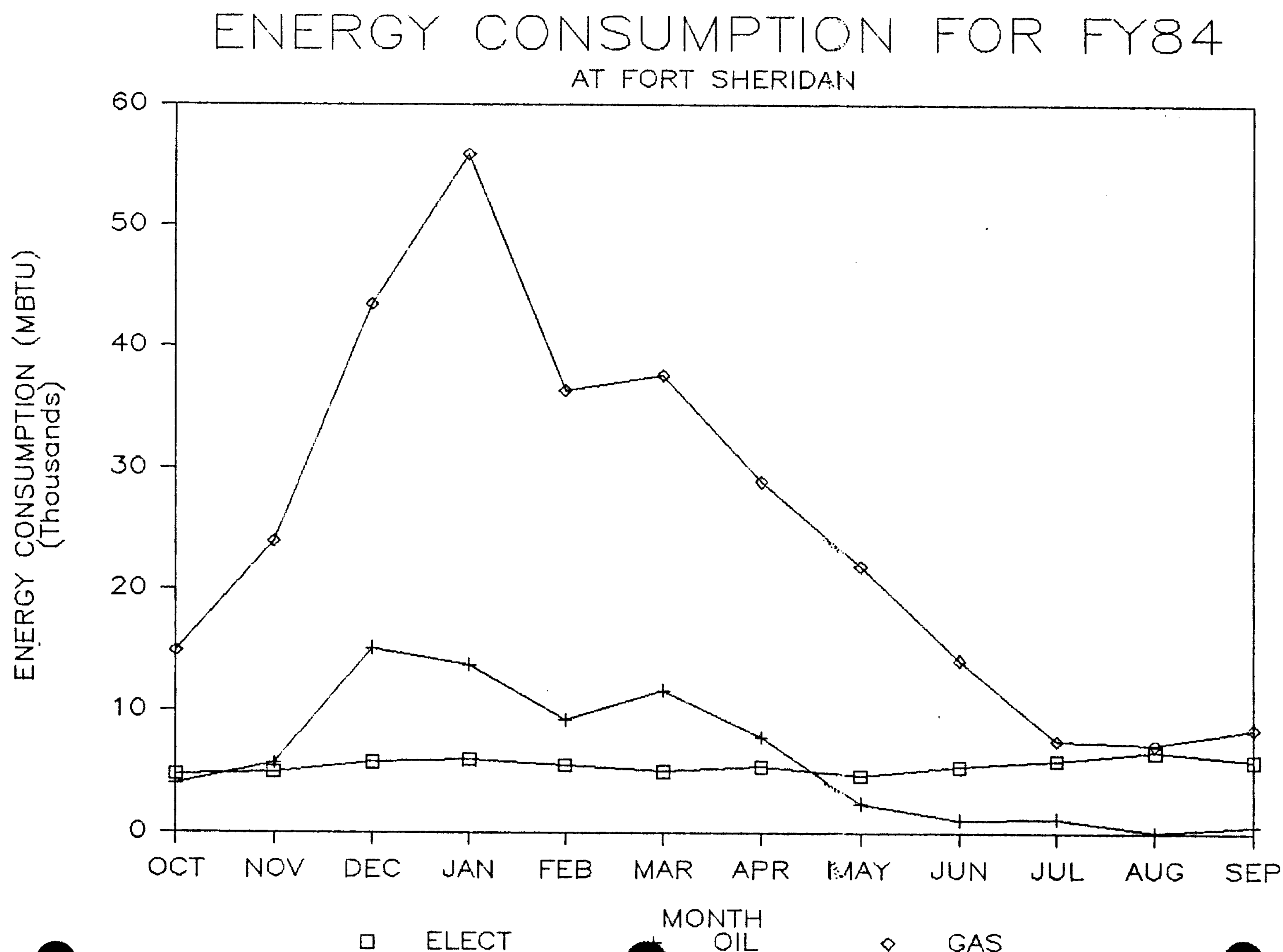

ENERGY CONSUMPTION FOR FY83
AT FORT SHERIDAN
ENERGY CONSUMPTION (MBTU)
(Thousands)
45
40
35
30
25
20
15
10
5
0
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
MONTH
ELECT
OIL
GAS

Figure 11



ENERGY CONSUMPTION FOR FY84
AT FORT SHERIDAN
ENERGY CONSUMPTION (MBTU) (Thousands)
60
50
40
30
20
10
0
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
MONTH
ELECT
OIL
GAS

Figure 12

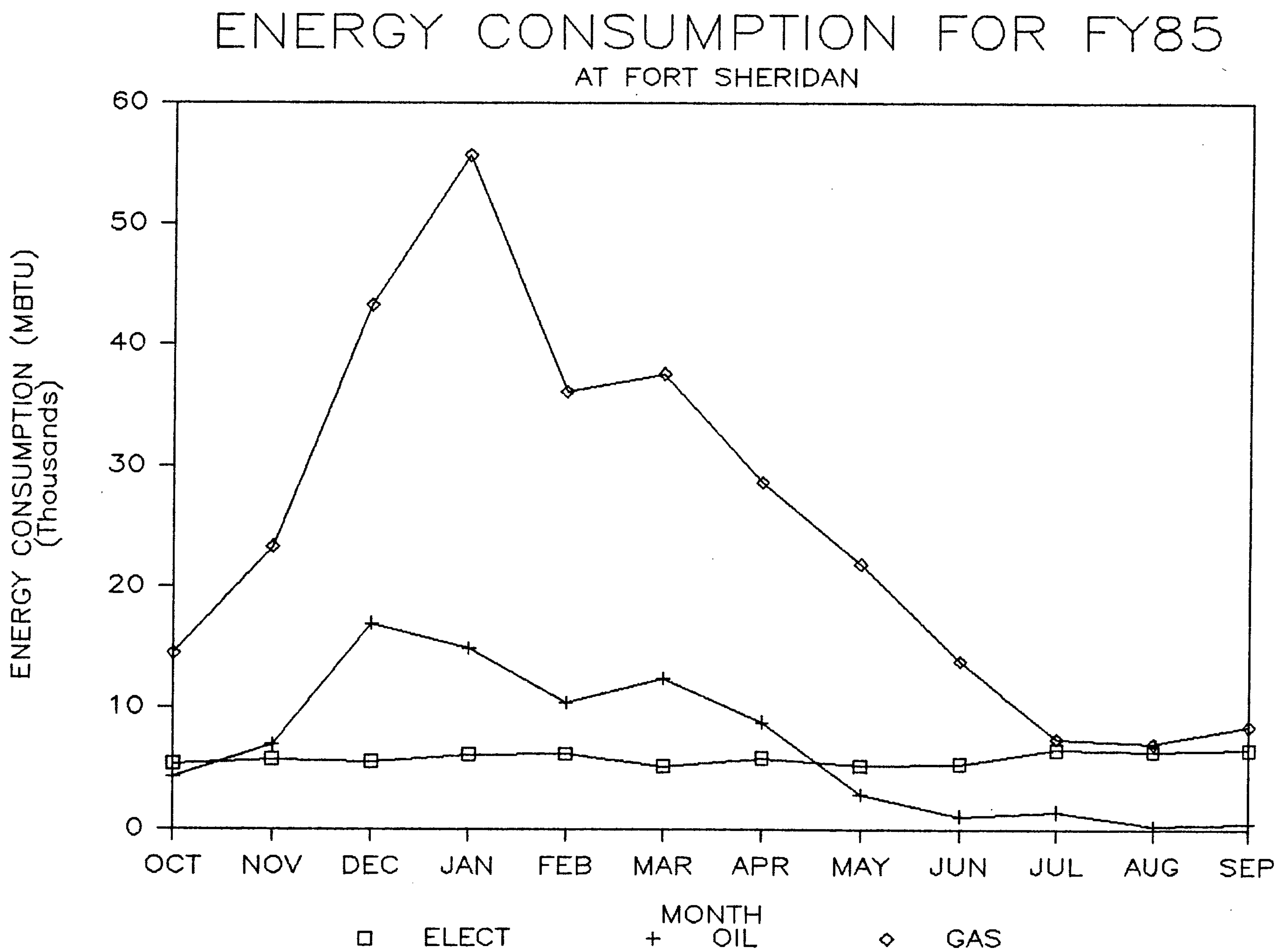
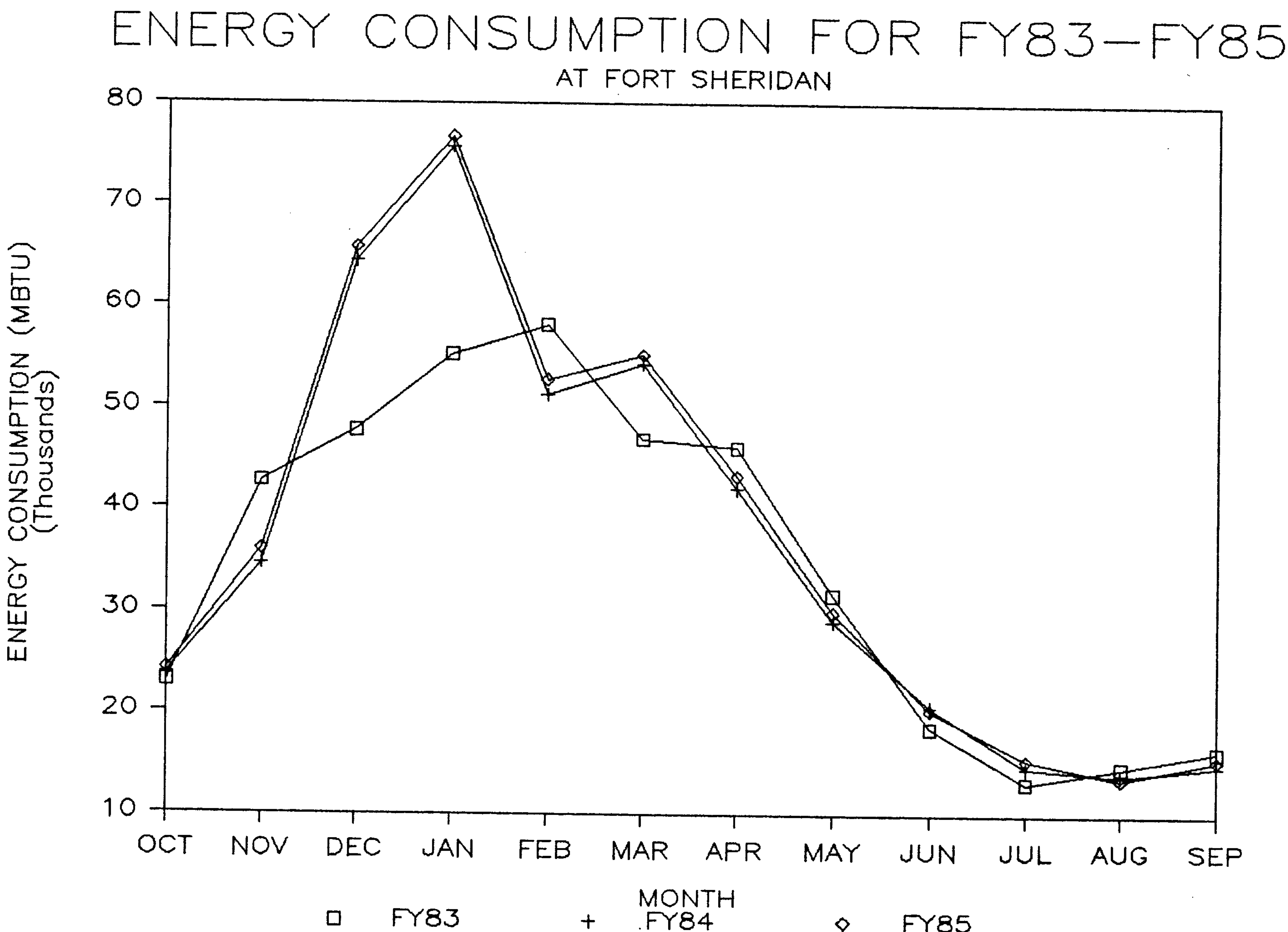

ENERGY CONSUMPTION FOR FY85
AT FORT SHERIDAN
ENERGY CONSUMPTION (MBTU)
(Thousands)
0
10
20
30
40
50
60
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
MONTH
ELECT
OIL
GAS

Figure 13


ENERGY CONSUMPTION FOR FY83—FY85
AT FORT SHERIDAN
ENERGY CONSUMPTION (MBTU)
(Thousands)
80
70
60
50
40
30
20
10
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
MONTH
FY83
FY84
FY85

gure 14

5.1 Project Execution

5.1.1 Field Survey, audit-data

Approximately 350 buildings were included in the post energy study. Each building was surveyed and plans were examined. Where a group of similar buildings was defined, one building was surveyed and presumed typical of the entire group. The energy entering the building was identified, by source and quantified; construction, recorded condition, estimated equipment types and sizes, etc. were recorded.

Survey Areas:

Architectural features of building shell including wall, roof, and fenestration details, access for reinsulation, and condition.

Mechanical features of HVAC (i.e. fans, chillers, pumps, condensors, and controls).

Electrical features of lighting and power distribution.

Distribution Systems for power, steam, condensate, natural gas, and outdoor lighting.

Data gathered from field observation and building plans was organized into a computerized data base. Data diskettes in the DBIII format will be availabe to the post staff in MSDOS. The DBIII program and Lotus 1-2-3 program diskettes are used to interpret and reconfigure building data as desired for analysis, consolidation, planning, and energy program monitoring.

5.1.2 ECO Computation - Life Cycle Analysis

A list of Energy Conservation Opportunities was established using the list provided in the scope-of-work and additional ECOs from the AE's experience.

5.1 (Cont'd)

For each ECO, applicable buildings were identified. For each building, installation costs were estimated and energy savings for each energy source were calculated.

Manual and computerized methods were used to perform energy calculations.

Life Cycle Cost Analysis (LCCA) has been performed for all buildings. SIR values are presented for each building comprising an ECO, for the complete ECO and for the entire project (ECIP) which may include more than one ECO. Non energy savings have been considered for each ECO.

5.1.3 Review and Verification

COE and Fort Sheridan DEH staff assisted in project classification and consolidation for preparation of programming documents.

6.1 Energy Conservation Opportunities

6.1.1 Summary of Projects

The basewide energy study at Fort Sheridan has yielded twenty-six energy projects. They incorporate thirty-one Energy Conservation Opportunities (ECOs) within the Four Increments (A, B, F and G). There are six Increment A projects, two Increment B projects, seven Increment F projects and eleven Increment G projects.

Implementation of all projects is estimated at $4,019,060. This figure includes $2,794,360 in building related projects and $1,224,700 for steam projection and distribution projects. Added together, first year savings for building projects are $886,977 resulting from reductions of 10, 41, and 46 percent of electric, oil and gas (39 percent reduction in total energy) consumption. Added together, savings from steam system projects are $777,250 resulting from a 57 percent reduction of gas (38 percent reduction in total energy) consumption as compared to FY85.

Looking at total basewide energy consumption, the sum of the calculated savings is a 76 percent reduction. However, a 62 percent projection is more realistic. This estimate is based on the full effect of the building projects (39 percent) plus an adjusted (23 percent) effect of performing the Central Steam Plant related work ([100% - 39%] x 38% = 23%).

6.1.2 Increment A Projects

Increment A projects involve retrofit of existing buildings. Table 1 summarizes Increment A projects. The total retrofit cost of

6.1 (Cont'd)

6.1.2 Summary of Projects (Cont'd)

$1,900,414 would result in annual cost saving of $388,250, and total annual energy savings of 73,089 MBTUs of electricity, gas and oil.

Six ECIP projects have been compiled. ECIPs 1 and 4 are insulation projects. ECIPs 2 and 3 are projects that reduce infiltration by improving seals around windows and doors. ECIP 5 converts to more efficient types of lighting. ECIP 6 upgrades radiator controls.

6.1.3 Increment B Projects

Increment B Projects involve basewide energy distribution systems and control. The estimated 1985 cost of $1,505,200 will yield a savings of $529,900. Annual energy savings are projected at 84,534 MBTU's of electric, gas and oil.

ECIP 7 provides a distributed Energy Monitoring and Control System (EMCS). ECIP 8 replaces the Central Steam Plant with a number of smaller boilers at point of use as a stand alone project. ECIP 8* replaces the Central Steam Plant with smaller boilers at point of use after improving the efficiency of the central plant.

Table 2 summarizes Increment B projects. To reduce the amount of synergism in the calculations, ECIP8* data was used. Both ECIP8 and ECIP8* data are presented for informational and decision making purposes.

6.1 (Cont'd)

6.1.4 Increment F Projects

Increment F projects involve low cost/no cost projects. Seven projects were developed with an investment of $140,652. Annual savings of $301,085 are estimated. Annual savings estimates are 93,153 MBTUs of electric, gas and oil.

The seven projects involve domestic hot water usage and generation, improved condensate return to the Central Steam Plant, installing lower wattage flourescents, and destratifying air with paddle type fans.

Table 3 summarizes Increment F projects.

6.1.5 Increment G Projects

Increment G projects involve non ECIP projects. Eleven projects were developed, three under the Productivity Enhancing Capital Investment Program (PECIP) and eight under the Quick Return Investment Program (QRIP). In total, these projects will cost $472,794 and save $444,992 per year, based on 1985 fuel and construction cost estimates. The annual energy savings are 91,624 MBTUs. Table 4 summarizes Increment G projects.

PROJECT IDENT.	ECO#	INCREMENT A DESCRIPTION	ENERGY CONSERVATION PROJECTS FIRST YEAR SAVINGS	CONSTR. COST	SIR	SAP	ANNUAL SAVINGS ELEC. (MBTU)	ANNUAL SAVINGS OIL (MBTU)	ANNUAL SAVINGS GAS (MBTU)
ECIP1	01	WALL INSULATION A	$1,280	$2,131	12.03	1.66	0	0	305
ECIP1	02	WALL INSULATION B	$43,273	$265,653	3.08	6.14	69	2,970	5,101
ECIP1	03	WALL INSULATION C	$2,604	$21,357	2.43	8.20	1	0	615
ECIP1	04	WALL INSULATION D	$34,127	$171,508	3.64	5.03	222	1,469	4,635
ECIP1	05	ROOF INSULATION A	$36,423	$27,808	24.91	0.76	0	2,978	3,794
ECIP1	06	ROOF INSULATION B	$3,165	$7,330	7.87	2.32	0	460	0
ECIP1	07	ROOF INSULATION C	$1,681	$3,148	9.73	1.87	0	244	0
ECIP1	08	ROOF INSULATION D	$11,697	$39,150	5.78	3.35	43	0	2,575
ECIP1	31	ROOF INSULATION E	$18,073	$62,214	5.08	3.44	208	643	2,234
SUBTOTAL			$152,323	$600,299	4.74	3.94	543	8,764	19,259
ECIP2	10	WEATHERSTRIPPING	$30,850	$114,118	5.37	3.70	0	444	6,618
ECIP2	11	CAULKING	$1,256	$19,669	1.28	15.66	0	0	299
ECIP2	12	STORM WINDOWS	$4,104	$25,230	3.16	6.15	10	60	830
SUBTOTAL		FAMILY HOUSING ONLY	$36,210	$159,017	4.51	4.39	10	504	7,747
ECIP3	10	WEATHERSTRIPPING	$70,270	$230,585	5.95	3.28	67	1,855	13,365
ECIP3	11	CAULKING	$7,814	$95,195	1.55	12.18	10	563	888
ECIP3	12	STORM WINDOWS	$22,537	$129,842	3.27	5.76	110	520	3,977
SUBTOTAL			$100,621	$455,622	4.27	4.53	187	2,938	18,230
ECIP4	02	WALL INSULATION B	$23,968	$191,459	2.47	7.99	1	517	4,855
ECIP4	04	WALL INSULATION D	$852	$10,314	1.65	12.11	0	0	203
ECIP4	06	ROOF INSULATION B	$2,551	$7,323	6.98	2.87	0	0	607
ECIP4	23	WATER HEATER JACKETS	$4,127	$30,965	2.65	7.50	3	0	969
SUBTOTAL		FAMILY HOUSING ONLY	$31,498	$240,061	2.6	7.62	4	517	6,634
ECIP5	16	REDUCE LIGHTING	$9,155	$20,991	4.86	2.29	384	0	0
ECIP5	20	HIGH EFF. LIGHTS	$29,216	$163,754	2.00	5.60	1,122	0	0
SUBTOTAL			$38,371	$184,745	2.32	4.81	1,506	0	0
ECIP6	26	THERMOSTATIC RAD. VALVES	$29,227	$260,670	1.44	8.92	0	1,117	5,129
SUBTOTAL			$29,227	$260,670	1.44	8.92	0	1,117	5,129
TOTAL			$388,250	$1,900,414		4.89	2250	13840	56999

Table 1

INCREMENT B ENERGY CONSERVATION PROJECTS

PROJECT IDENT.	ECO#	DESCRIPTION	FIRST YEAR SAVINGS	CONSTR. COST	SIR	SAP	ANNUAL SAVINGS ELEC. (MBTU)	ANNUAL SAVINGS OIL (MBTU)	ANNUAL SAVINGS GAS (MBTU)
ECIP8	29	CENTRAL PLANT ELIMINATION	$679,371	$1,056,200	7.98	1.55	0	0	133,157
SUBTOTAL			$679,371	$1,056,200	7.98	1.55	0	0	133,157
ECIP8#	29	**CENTRAL PLANT ELIMINATION**	**$404,513**	**$1,042,200**	**4.45**	**2.58**	**0**	**0**	**56,582**
SUBTOTAL		**(AFTER BOILER RELATED PROJECTS)**	**$404,513**	**$1,042,200**	**4.45**	**2.58**	**0**	**0**	**56,582**
ECIP7	13	EMCS	$125,387	$463,000	3.41	3.69	2,023	0	25,929
SUBTOTAL			$125,387	$463,000	3.41	3.69	2,023	0	25,929
TOTAL			$529,900	$1,505,200		2.84	2,023	0	82,511

Table 2

PROJECT IDENT.	ECO#	INCREMENT F DESCRIPTION	ENERGY CONSERVATION PROJECTS FIRST YEAR SAVINGS	CONSTR. COST	SIR	SAP	ANNUAL SAVINGS ELEC. (MBTU)	ANNUAL SAVINGS OIL (MBTU)	ANNUAL SAVINGS GAS (MBTU)
INCF1	15	CONDENSATE RETURN	$286,646	$100,000	41.42	0.35	0	0	90,630
SUBTOTAL			$286,646	$100,000	41.42	0.35	0	0	90,630
INCF2	22	SHOWER FLOW RESTRICTORS	$8,664	$6,394	25.65	0.74	0	766	808
SUBTOTAL			$8,664	$6,394	25.65	0.74	0	766	808
INCF3	23	WATER HEATER JACKETS	$1,269	$6,325	3.12	4.98	28	50	85
SUBTOTAL			$1,269	$6,325	3.12	4.98	28	50	85
INCF7	30	LOWER WATTAGE FLUORESCENTS	$547	$2,688	2.25	4.91	27	0	0
SUBTOTAL			$547	$2,688	2.25	4.91	27	0	0
INCF4	17	DESTRATIFICATION FANS	$2,219	$15,900	2.04	7.17	(41)	20	696
SUBTOTAL			$2,219	$15,900	2.04	7.17	(41)	20	696
INCF5	18	WATER HEATER SHUTDOWN	$1,212	$6,141	1.79	5.07	59	0	0
SUBTOTAL			$1,212	$6,141	1.79	5.07	59	0	0
INCF6	21	CONTROL H W PUMPS	$528	$3,204	1.5	6.07	26	0	0
SUBTOTAL			$528	$3,204	1.5	6.07	26	0	0
TOTAL			$301,085	$140,652		0.47	98	836	92,219

Table 3

PROJECT IDENT.	ECO#	INCREMENT 6 DESCRIPTION	ENERGY CONSERVATION PROJECTS FIRST YEAR SAVINGS	CONSTR. COST	SIR	SAP	ANNUAL SAVINGS ELEC. (MBTU)	ANNUAL SAVINGS OIL (MBTU)	ANNUAL SAVINGS GAS (MBTU)
PECIP1	24	FLUE DAMPERS	$33,623	$90,240	4.88	2.68	0	173	7,722
SUBTOTAL		FAMILY HOUSING ONLY	$33,623	$90,240	4.88	2.68	0	173	7,722
PECIP2	25	OIL TO GAS CONVERSIONS	$4,703	$11,000	4.45	2.34	0	1,755	(1,755)
SUBTOTAL		FAMILY HOUSING ONLY	$4,703	$11,000	4.45	2.34	0	1,755	(1,755)
PECIP3	20	HIGH EFF. LIGHTS	$15,251	$51,310	3.21	3.36	1,098	0	0
SUBTOTAL		FAMILY HOUSING ONLY	$15,251	$51,310	3.21	3.36	1,098	0	0
QRIP1	19	NIGHT SETBACK THERMOSTATS	$127,366	$33,500	49.00	0.26	56	3,504	24,312
SUBTOTAL			$127,366	$33,500	49.00	0.26	56	3,504	24,312
QRIP2	22	SHOWER FLOW RESTRICTORS	$41,356	$34,684	23.73	0.84	28	0	9,710
SUBTOTAL		FAMILY HOUSING ONLY	$41,356	$34,684	23.73	0.84	28	0	9,710
QRIP3	27	BOILER STACK HEAT RECOVERY	$59,900	$49,000	16.13	0.82	0	0	14,500
QRIP3	28	BOILER BLOWDOWN HEAT REC.	$12,440	$13,500	12.39	1.09	0	0	3,200
SUBTOTAL			$72,340	$62,500	15.32	0.86	0	0	17,700
QRIP4	24	FLUE DAMPERS	$26,114	$22,560	14.56	0.86	0	1,974	2,984
SUBTOTAL			$26,114	$22,560	14.56	0.86	0	1,974	2,984
QRIP5	09	FLOOR INSULATION	$54,099	$71,260	14.24	1.32	53	4,778	4,795
SUBTOTAL			$54,099	$71,260	14.49	1.32	53	4,778	4,795
QRIP7	19	NIGHT SETBACK THERMOSTATS	$40,476	$56,400	9.38	1.39	0	273	9,190
SUBTOTAL		FAMILY HOUSING ONLY	$40,476	$56,400	9.38	1.39	0	273	9,190
QRIP8	14	SUMMER SHUTDOWN	$13,751	$20,000	9.02	1.45	0	0	3,274
SUBTOTAL			$13,751	$20,000	9.02	1.45	0	0	3,274
QRIP6	25	OIL TO GAS CONVERSIONS	$15,913	$19,340	8.57	1.22	0	5,938	(5,938)
SUBTOTAL			$15,913	$19,340	8.57	1.22	0	5,938	(5,938)
TOTAL			$444,992	$472,794		1.06	1,235	18,395	71,994

Table 4

7.1 Description of Project ECOs

7.1.1 Viable Project ECOs

Wall Insulation Type A - ECO No. 1

1-1/4 inch rigid insulation with embossed finish will be added to walls.

Wall Insulation Type B - ECO No. 2

Four inch blown-in insulation will be added to walls.

Wall Insulation Type C - ECO No. 3

Six inch blown in insulation will be added to walls.

Wall Insulation Type D - ECO No. 4

Foamed in insulation will be added to concrete block walls.

Roof Insulation Type A - ECO No. 5

3-1/2 inch fiberglass roof insulation will be added in uninsulated or underinsulated roofs.

Roof Insulation Type B - ECO No. 6

6 inch fiberglass batts will be added to uninsulated or underinsulated roofs.

Roof Insulation Type C - ECO No. 7

1-3/4 inch rigid insulation with embossed finish to uninsulated or underinsulated roofs will be added.

Roof Insulation Type D - ECO No. 8

2-3/4 inch rigid insulation with embossed finish to uninsulated or underinsulated roofs will be added.

Floor Insulation - ECO No. 9

3-1/2 inch foil faced insulation will be installed under the building to reduce heat transmission.

7.1 (Cont'd)

Weatherstripping - ECO No. 10

Weatherstripping materials will be added to windows and doors.

Caulking - ECO No. 11

Caulking materials will be added to windows and doors.

Window Improvement - ECO No. 12

Storm windows will be installed.

Energy Monitoring and Control System (EMCS) - ECO No. 13

Energy controls will be enhanced and upgraded by installing a network of microprocessor based controllers.

Summertime Central Boiler Plant Shutdown - ECO No. 14

Water heaters will be installed for hot water and heating purposes in buildings that currently require and need steam in summer. This would allow the Central Boiler Plant to be shut down.

Condensate Return Maintenance Program - ECO No. 15

A regular program of steam trap inspection, cleaning, and replacement will be recommended. Recommend replacement of leaking and poorly insulated underground steam condensate lines. Recommend maintenance and/or replacement of condensate return pumps and sump pumps.

Reduce Lighting Levels - ECO No. 16

Lights will be removed in overlit areas.

Destratification Fans - ECO No. 17

Destratification fans will be installed to mix higher air (warmer) with lower air (cooler) by means of a propeller fan.

Shutdown Energy to Hot Water Heaters or Modify Controls - ECO No. 18

Hot water heaters will be shutdown except for use during peak demand.

7.1 (Cont'd)

Night Setback Thermostats - ECO No. 19

Night setback thermostats will be installed.

High Efficiency Lights - ECO No. 20

Incandescent light fixtures will be replaced with lower wattage fluorescent.

Control Hot Water Circulation Pump - ECO No. 21

Hot water circulation pumps will be controlled to run only during occupied hours.

Install Shower Flow Restriction - ECO No. 22

Shower heads will be limited to 2 to 3 gallons per minute.

Water Heater Jackets - ECO No. 23

Insulating blanket or more insulation will be added.

Flue Dampers - ECO No. 24

Flue dampers will control the flow of air through the heat exchanger and exhaust up the flue.

Oil-Gas Conversion - ECO No. 25

It may be economically feasible to convert from oil heating systems to gas systems.

Thermostatic Radiator Valves - ECO No. 26

Individual thermostatically controlled radiator valves will be installed.

Boiler Stack Heat Recovery - ECO No. 27

Heat recovery equipment will be installed in the stack. Boiler water would be preheated with this waste heat before entering the deaerator tank.

7.1 (Cont'd)

Boiler Blowdown Heat Recovery - ECO No. 28

Heat exchangers to capture heat presently being lost and preheat cold make up water will be installed.

Central Steam Plant Elimination - ECO No. 29

Heating from the Central Steam Plant will be replaced by localized heat generation at point of use.

Lower Wattage Fluorescents - ECO No. 30

Forty watt fluorescent lamps will be replaced with thirty-four watt lamps.

Roof Insulation Type E - ECO No. 31

Nine inch fiberglass batts will be added to uninsulated or underinsulated roofs in air conditioned buildings.

7.1.2 Nonviable ECOs

Many identified ECOs were considered and rejected for detailed analysis due to being inapplicable, impractical or uneconomical. Below are descriptions of these ECOs and reasons for rejection.

Outside Air Reset for Hot Water Boilers

Modifications to boiler or heat exchanger controls, which changes the hot water supply setpoint in inverse proportion to outside air temperature. During the course of gathering field data, it was observed that there were existing outside air reset controls on water heating units, none of which are known to be inoperative.

Insulated Panels

Insulated panels are installed on exterior walls to reduce heat transmission. Based on past studies, this ECO has very poor economics, with simple payback periods in excess of 20 years.

Replace Absorption Chiller with Centrifugal Chiller - ECO No. 33

There are no absorption chillers at Fort Sheridan, therefore, this ECO is inapplicable.

Reduce Ventilation Air Flow

The renovated and cooled buildings have been converted to variable air volume. Constant volume units are properly sized to meet ventilation requirements.

Waste Incinerator

The quantities of refuse do not appear sufficient to support enough cost avoidance to offset the capital expense of installing a waste incinerator within payback criteria.

Vestibules

There were no "high traffic" doorways identified by the study.

7.1 (Cont'd)

Solar Film

Solar load through windows is less than 5% of cooling load. In winter, solar load has the net effect of adding heat to the building which reduces heating requirements.

Reduction of Glass Area

Proposes blocking of glass area with insulated board rejected due to expected poor economics.

Heat Reclaim from Refrigeration

Domestic hot water use is not very high and the cost to install heat recovery on outdoor air cooled condensing units would be prohibitive.

Insulate Steam Lines

Existing above ground steam lines appear to be adequately insulated at Fort Sheridan.

Peak Shaving Generator

The economics is poor contrasted with the present cost of electricity, including demand charges.

Water Source Heat Pumps

This ECO involves using Lake Michigan as the heat sink/source for heat pumps. The ECO was rejected for further study due to Environmental Protection Agency (EPA) and state water control limitations on withdrawal of lake water and reintroduction of heated water. No large cooling requirement is close to lake shore.

Reduce Street Lights

Existing street lighting is adequate and no reductions are recommended.

Improve Power Factor

Commonwealth Edison does not have a power factor penalty in its rate structure.

7.1 (Cont'd)

Infrared Heaters

Large doors suitable for local heaters are not used very much. Economics would be poor.

Decentralize Domestic Hot Water Heaters

Domestic hot water is not presently centralized.

Boiler Control and Trim Controls

It appears that existing controls and operating procedures are effective in maintaining high efficiencies. Suggested that existing meters be evaluated for accuracy. After accurate data is available, the possibility of updating boiler controls may warrant consideration.

Revise or Repair Building HVAC Controls

Base staff is not aware of any inoperative controls. The condition of existing temperature controls range from excellent to poor.

Domestic Hot Water Heat Pumps

Hot water requirements are minimal and the anticipated cost of a heat pump is high.

Load Dock Seals

Loading and unloading time (when large door is open) is minimal.

Point of Use Domestic Water Heater Booster

Heating water with electricity is approximately four times more costly than using natural gas. Standby losses are small compared to the installation costs of either gas or electric units.

Install Timers on Residential Hot Water Pumps

The high cost of timers with backup power yielded an SIR = 0.9.

Install Timers on Residential Water Heaters

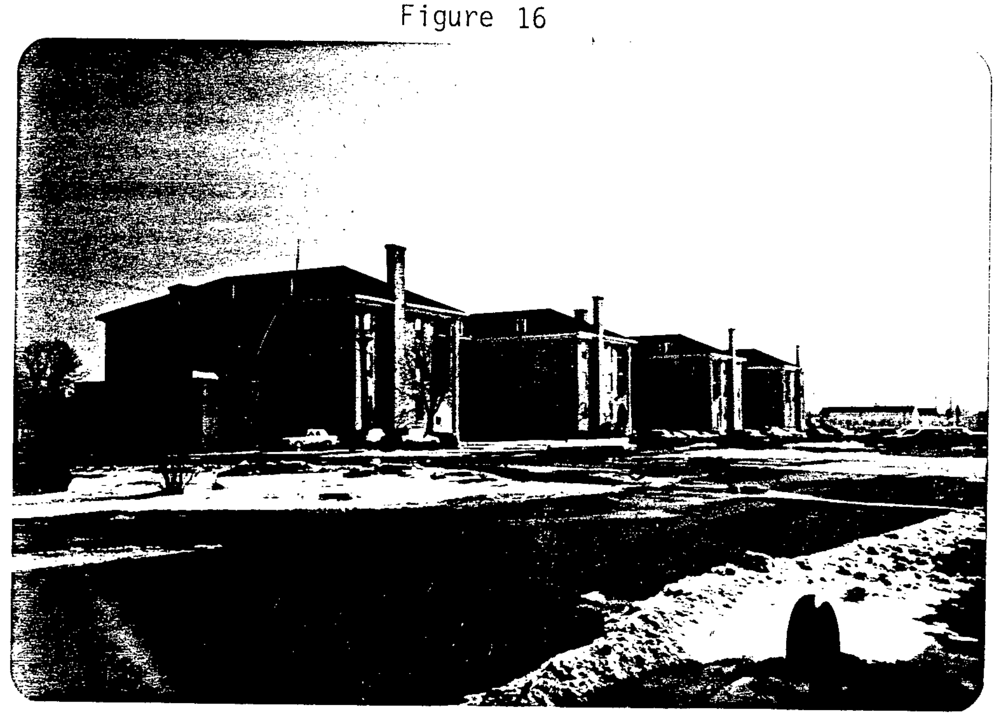
The high cost of timers with backup power yielded an SIR = 0.5.

8.1 Photographs Illustrating Representative Type Building Construction and Age Fort Sheridan, Illinois

Bldg. No. 142 Front Entrance General Administration Built 1939

Figure 15

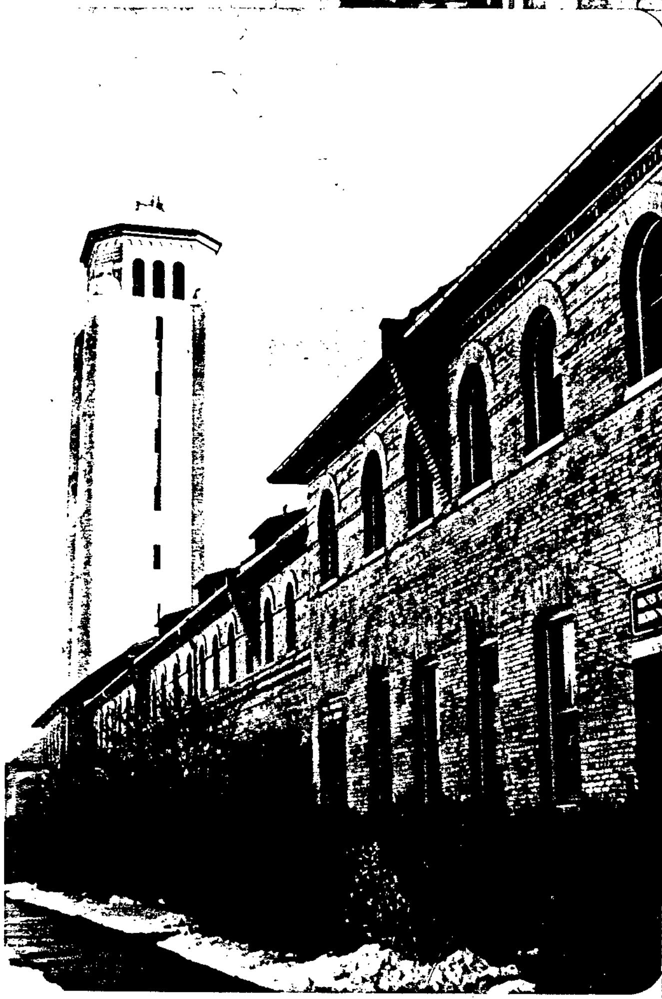
Figure 16



Bldg. No. 142 four building Administration Complex (connected) Built 1939

Bldg. No. 48 Administration category - historical recent storm window and window caulking modifications

Figure 17



Bldg. No. 48,49 and Tower General Administration category - historical

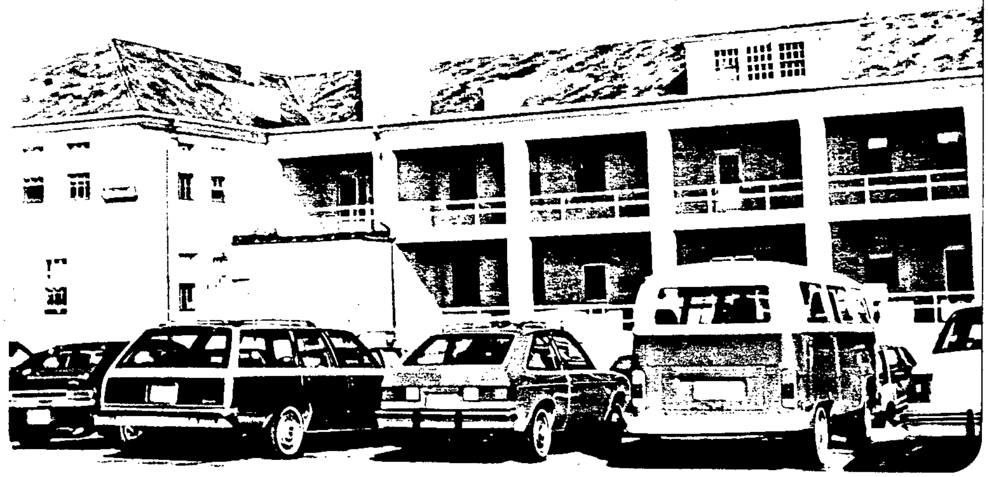
Figure 18

Figure 19

Bldg. No. 48 General Administration category historical Faces parade ground

Figure 20

Bldg. No. 140
Post Headquarters
Historical
Built 1939



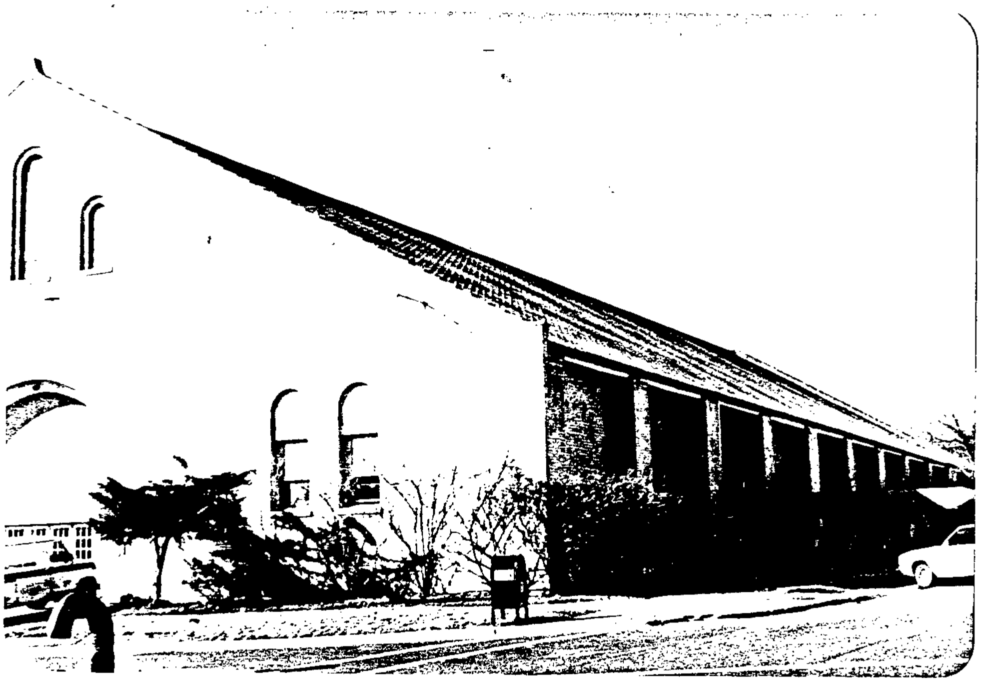


Figure 21

Bldg. No. 60
Gymnasium
Historical
Built 1893

Figure 22

Bldg. No. 43
QM Repair Shop
Historical
Built 1890

Figure 23

Bldg. No. 847
Family Housing
Officer
Built 1967

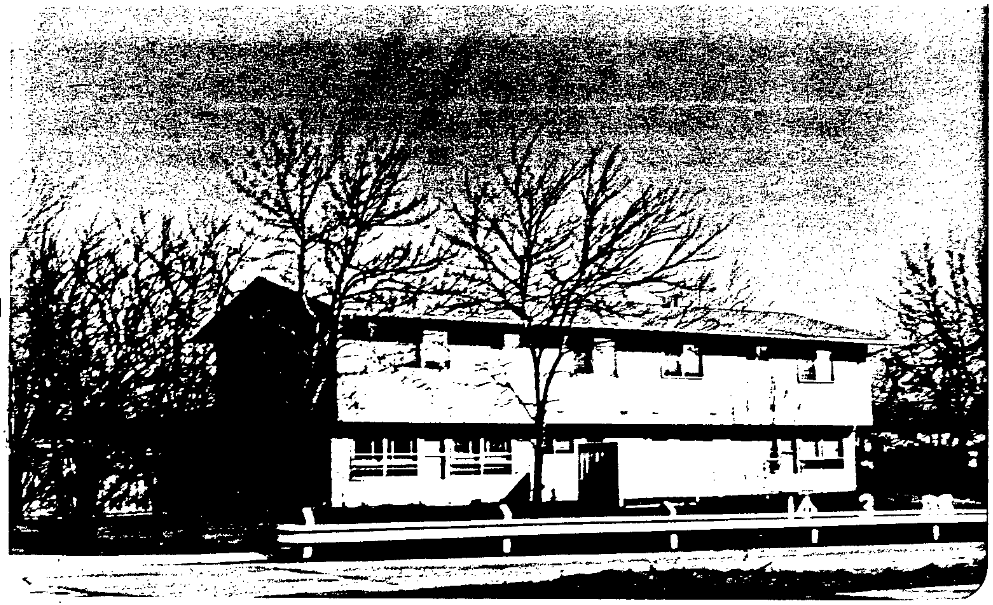


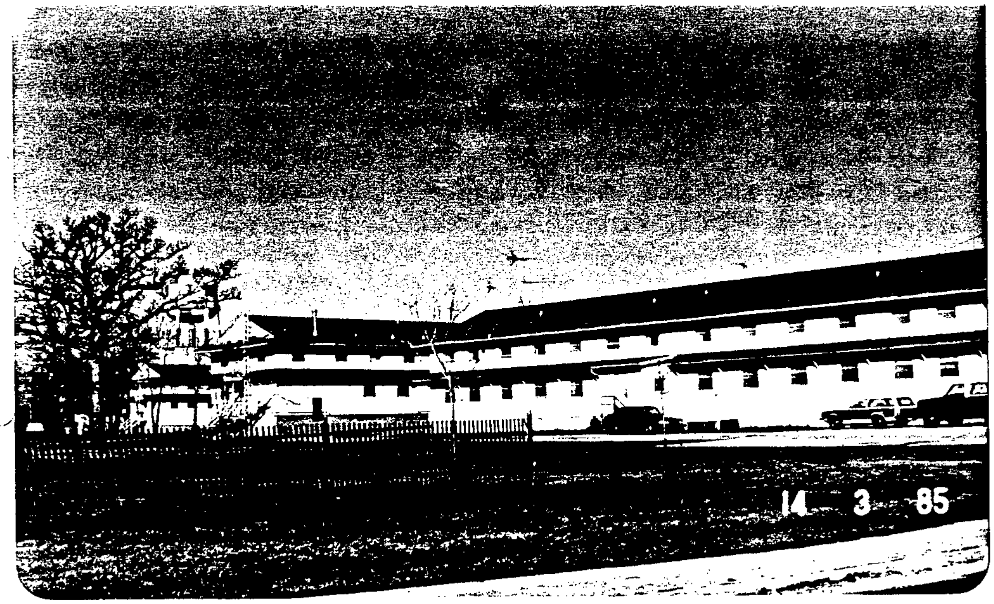
Figure 24

Family
Housing

Figure 25
Family
Housing

Figure 26

Bldg. No. 423
Administration
Built 1940



Bldg. Nos. T550-T552
(Not in Study)
Built 1941

Figure 27

Figure 28

Bldg. Nos. 454-457
Quarters
Built 1941

8.2 CONCLUSION

Our conclusions are based on a detailed audit and analysis of the structure and energy system of each building, audit and analysis of the Central Steam Plant and distribution system, review of planned additions, modifications and demolitions, analysis of energy rates and trends in the Chicago area and historical energy usage trends at Fort Sheridan. The study has yielded twenty-six energy projects which are summarized in Table 5.

We conclude that the adoption and implementation of the energy plan described in this report indicates a 62 percent reduction in energy consumption can be achieved.

We conclude that the quickest and most significant means to achieve energy reductions is early implementation of the basewide thermal insulation program.

We conclude that implementation of the Central Steam Plant elimination project would reduce heating energy consumption by 38 percent and reduce the high maintenance costs associated with the deteriorating underground steam distribution system.

We conclude that installation of an EMCS should be a priority based on the addition of air conditioning to the base and the prevailing high electrical rates, which are among the highest in the country.

We conclude that little opportunity exists in the operation of the physical plant to significantly reduce electrical demand costs without seriously impacting the base military support functions.

We finally conclude that the capital and base maintenance improvements recommended in this report will permit Fort Sheridan to exceed energy conservation goals established by Executive Order 12003 and recent Army directives which redirect the 1975-1985 ten year program goals.

SUMMARY OF ENERGY PROJECTS

PROJECT IDENT.	FIRST YEAR SAVINGS	CONSTR. COST	SIR	SAP	ANNUAL SAVINGS ELEC. (MBTU)	ANNUAL SAVINGS OIL (MBTU)	ANNUAL SAVINGS GAS (MBTU)
ECIP1	$152,323	$600,299	4.74	3.94	543	8,764	19,259
ECIP2	$36,210	$159,017	4.51	4.39	10	504	7,747
ECIP3	$100,621	$455,622	4.27	4.53	187	2,938	18,230
ECIP4	$31,498	$240,061	2.6	7.62	4	517	6,634
ECIP5	$38,371	$184,745	2.32	4.81	1,506	0	0
ECIP6	$29,227	$260,670	1.44	8.92	0	1,117	5,129
ECIP7	$125,387	$463,000	3.41	3.69	2,023	0	25,929
ECIP8	$679,371	$1,056,200	7.98	1.55	0	0	133,157
ECIP8*	$404,513	$1,042,200	4.45	2.58	0	0	56,582
INCF1	$286,646	$100,000	41.42	0.35	0	0	90,630
INCF2	$8,664	$6,394	25.65	0.74	0	766	808
INCF3	$1,269	$6,325	3.12	4.98	28	50	85
INCF4	$2,219	$15,900	2.04	7.17	(41)	20	696
INCF5	$1,212	$6,141	1.79	5.07	59	0	0
INCF6	$528	$3,204	1.5	6.07	26	0	0
INCF7	$547	$2,688	2.25	4.91	27	0	0
PECIP1	$33,623	$90,240	4.88	2.68	0	173	7,722
PECIP2	$4,703	$11,000	4.45	2.34	0	1,755	(1,755)
PECIP3	$15,251	$51,310	3.21	3.36	1,098	0	0
QRIP1	$127,366	$33,500	49.00	0.26	56	3,504	24,312
QRIP2	$41,356	$34,684	23.73	0.84	28	0	9,710
QRIP3	$72,340	$62,500	15.32	0.86	0	0	17,700
QRIP4	$26,114	$22,560	14.56	0.86	0	1,974	2,984
QRIP5	$54,099	$71,260	14.24	1.32	53	4,778	4,795
QRIP6	$15,913	$19,340	8.57	1.22	0	5,938	(5,938)
QRIP7	$40,476	$56,400	9.38	1.39	0	273	9,190
QRIP8	$13,751	$20,000	9.02	1.45	0	0	3,274

Table 5